IN THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application.

Listing of Claims:

1 (currently amended). A method of extracting features for a lighting-invariant face description, comprising ~~the steps of~~:

getting adjusted second-order eigenfeatures of a face image;

quantizing ~~said~~ the adjusted second-order eigenfeatures; and

selecting features to construct a face descriptor to describe faces from the ~~said~~ quantized second-order eigenfeatures.

2 (currently amended). A method of extracting features for a lighting-invariant face description, comprising ~~the steps of~~:

getting adjusted second-order eigenfeatures of a face image;

quantizing ~~said~~ the adjusted second-order eigenfeatures;

selecting features to construct a face descriptor to describe faces from the ~~said~~ quantized second-order eigenfeatures; and

coding ~~said~~ the selected eigenfeatures in ~~the~~ a lighting-invariant face descriptor.

3 (currently amended). A method of extracting features for a view-angle-invariant face description, comprising ~~the steps of~~:

getting adjusted first-order eigenfeatures of a face image;

getting adjusted second-order eigenfeatures of a face image;

quantizing ~~said~~ the adjusted first-order eigenfeatures;

quantizing ~~said~~ the adjusted second-order eigenfeatures; and

selecting features to construct a face descriptor to describe faces from ~~said~~ the quantized first-order and second-order eigenfeatures.

4 (currently amended). A method of extracting features for a view-angle-invariant face description, comprising ~~the steps of~~:

getting adjusted first-order eigenfeatures;

getting adjusted second-order eigenfeatures;

quantizing ~~said~~ the adjusted first-order eigenfeatures;

quantizing ~~said~~ the adjusted second-order eigenfeatures;

selecting features to construct a face descriptor to describe faces from ~~said~~ the quantized first-order and second-order eigenfeatures; and

coding ~~said~~ selected eigenfeatures in ~~the~~ a view-angle-invariant face descriptor.

5 (currently amended). The [[A]] method of [[in]] claim 1, wherein ~~of~~ getting adjusted second-order eigenfeatures of a face image ~~, comprising the step of~~ ~~comprises~~:

getting [[the]] a dot product of the face image and an adjusted second-order eigenface matrix.

6 (currently amended). The [[A]] method [[in]] of claim 3, wherein ~~of~~ getting adjusted first-order eigenfeatures of a face image ~~, comprising the step of~~ comprises:

getting [[the]] a dot product of the face image and an adjusted first-order eigenface matrix.

7 (currently amended). The [[A]] method of claim 6, further comprising computing [[said]] an adjusted first-order eigenface matrix ~~in claim 6, comprising the steps of~~ by:

calculating a first-order eigenface matrix; and

adjusting [[said]] the first-order eigenface matrix.

8 (currently amended). The [[A]] method of claim 5, further comprising

computing [[said]] the adjusted second-order eigenface matrix ~~in claim 5, comprising the steps of~~ by:

calculating a second-order eigenface matrix; and

adjusting [[said]] the second-order eigenface matrix.

9 (currently amended). The [[A]] method [[in]] of claim 7, wherein [[of]] adjusting the [[said]] first-order eigenfaces ~~, comprising the steps of~~ comprises:

getting [[the]] first-order eigenfeatures of [[the]] training face images;

arranging the first-order eigenface as a two dimensional array of [[the]] original images;

getting [[the]] a mirrored eigenface of [[said]] the two dimensional array;

weighting [[said]] the mirrored eigenface image;

adding [[said]] the weighted eigenface image to the [[said]] first-order eigenface;

re-arranging the first-order eigenface to obtain [[the]] a one-dimensional adjusted first-order eigenface;

normalizing the adjusted first-order ~~eigenfaces~~ eigenface;

getting [[the]] weights of [[the]] adjusted first-order eigenfeatures for a distance computation;

multiplying the weights of the first-order eigenfeatures for distance computation to the adjusted first-order eigenface matrix; and

quantizing the first-order eigenface matrix.

10 (currently amended). The [[A]] method [[in]] of claim 8, wherein [[of]] calculating [[the]] second-order eigenfaces ~~, comprising the steps of~~ comprises:

calculating a first-order eigenface matrix;

getting first-order eigenfeatures from [[the]] training face images;

calculating a pseudo-inverse of [[said]] the first-order eigenface matrix;

calculating [[the]] first-order reconstructed face images by multiplying the [[said]] first-order eigenfeatures to the [[said]] pseudo-inverse of the first-order eigenface matrix;

getting second-order residue images by subtracting the first-order reconstructed face images from [[the]] original images; and

getting the second-order eigenfaces by calculating [[the]] eigenvectors of [[said]] the second-order residue images.

11 (currently amended). The [[A]] method [[in]] of claim 8, wherein [[of]] adjusting [[the]] second-order eigenfaces ~~, comprising the steps of~~ comprises:

getting [[the]] second-order eigenfeatures of [[the]] training images by computing [[the]] dot products of [[the]] face images and [[the]] second-order eigenfaces;

re-shaping the second-order eigenfaces to [[the]] an original image shape and getting [[the]] left-right mirrored eigenface images;

weighting the mirrored eigenface images and adding them to [[the]] corresponding original image shaped second-order eigenface images;

re-arranging [[the]] original image shaped second-order eigenfaces to obtain [[the]] one-dimensional adjusted second-order eigenfaces;

normalizing the adjusted second-order eigenfaces;

getting [[the]] weights of second-order eigenfeatures for a distance computation;

multiplying the weights of second-order eigenfeatures for the distance computation to the adjusted second-order eigenface matrix; and

quantizing the second-order eigenface matrix.

12 (currently amended). The [[A]] method [[in]] of claim 9, wherein [[of]] quantizing the ~~adjusted~~ first-order eigenface matrix ~~, comprising the steps of~~ comprises:

getting [[the]] a maximum and a [[the]] minimum of the adjusted first-order eigenface matrix;

getting [[the]] a quantization [[step]] by dividing [[the]] an interval between [[said]] the maximum and [[said]] the minimum into a plurality of quantization levels;

dividing [[said]] the adjusted first-order eigenface matrix with [[said]] the quantization [[step]]; and

rounding [[said]] divided values to [[the]] nearest integers.

13 (currently amended). The [[A]] method [[in]] of claim 11, wherein [[of]] quantizing the ~~adjusted~~ second-order eigenface matrix ~~, comprising the steps of~~ comprises:

getting [[the]] a maximum and [[the]] a minimum of said adjusted second-order eigenface matrix;

getting [[the]] a quantization [[step]] by dividing [[the]] an interval between [[said]] the maximum and [[said]] the minimum into a plurality of quantization levels;

dividing [[said]] the adjusted second-order eigenface matrix with [[said]] the quantization [[step]]; and

rounding [[said]] divided values to [[the]] nearest integers.

14 (currently amended). The [[A]] method [[in]] of claim 1, wherein [[of]] getting [[the]] adjusted second-order eigenfeatures ~~, comprising the steps of~~ comprises:

getting [[the]] a recovered adjusted second-order eigenface by multiplying the [[said]] quantized second-order eigenface matrix with [[said]] a quantization [[step]];

and

getting [[the]] second-order eigenfeatures by multiplying each column-wise recovered adjusted second-order eigenface with [[the]] a row-wise image.

15 (currently amended). The [[A]] method [[in]] of claim 3, wherein [[of]] getting [[the]] adjusted first-order eigenfeatures ~~, comprising the steps of~~ comprises:

getting [[the]] a recovered adjusted first-order eigenface by multiplying the [[said]] quantized first-order eigenface matrix with [[said]] a quantization [[step]]; and

getting [[the]] first-order eigenfeatures by multiplying each column-wise recovered adjusted first-order eigenface with [[the]] a row-wise image.

16 (currently amended). The [[A]] method [[in]] of claim 1, wherein [[of]] quantizing the adjusted second-order eigenfeatures ~~, comprising of the steps of~~ comprises:

getting [[the]] a maximum and [[the]] a minimum of [[said]] the adjusted second-order eigenfeatures of [[the]] training images;

getting the quantization [[step]] by dividing [[the]] an interval between [[said]] the maximum and [[said]] the minimum into a plurality of quantization levels;

dividing [[said]] adjusted second-order eigenfeatures with [[said]] the quantization [[step]]; and rounding [[said]] divided values to [[the]] nearest integers.

17 (currently amended). The [[A]] method [[in]] of claim 1, wherein [[of]] quantizing the adjusted second-order eigenfeatures ~~, comprising of the steps of~~ comprises:

getting [[the]] a maximum and [[the]] a minimum of [[said]] adjusted second-order eigenfeatures of [[the]] training images;

getting the quantization [[step]] by dividing [[the]] an interval between [[said]] the maximum and [[said]] the minimum into a plurality of quantization levels;

dividing [[said]] adjusted second-order eigenfeatures with [[said]] the quantization [[step]];

rounding [[said]] divided values to [[the]] nearest integers;

allocating different number of bits to different eigenfeatures by computing [[the]] a rounded logarithm of [[the]] a standard deviation of [[the]] corresponding eigenfeatures in [[the]] a training set divided by a minimum of the standard deviations; and

quantizing [[said]] the eigenfeatures according to the corresponding bit allocation.

18 (currently amended). The [[A]] method [[in]] of claim 3, wherein [[of]]

quantizing the adjusted first-order eigenfeatures ~~, comprising of the steps of~~ comprises:

getting [[the]] a maximum and [[the]] a minimum of [[the]] adjusted first-order eigenfeatures of [[the]] training images;

getting the quantization [[step]] by dividing [[the]] an interval between [[said]] the maximum and [[said]] the minimum into a plurality of quantization levels;

dividing [[said]] the adjusted first-order eigenfeatures with [[said]] the quantization [[step]]; and

rounding [[said]] divided values to [[the]] nearest integers;

19 (currently amended). The [[A]] method [[in]] of claim 3, wherein [[of]] quantizing the adjusted first-order eigenfeatures ~~, comprising of the steps of~~ comprises:

getting [[the]] a maximum and [[the]] a minimum of [[the]] adjusted first-order eigenfeatures of [[the]] training images;

getting the quantization [[step]] by dividing [[the]] an interval between [[said]] the maximum and [[said]] the minimum into a plurality of quantization levels;

dividing [[said]] the adjusted first-order eigenfeatures with [[said]] quantization [[step]];

rounding [[said]] divided values to [[the]] nearest integers;

allocating different number of bits to different eigenfeatures by computing [[the]] a rounded logarithm of [[the]] a standard deviation of [[the]] corresponding eigenfeatures in [[the]] a training set divided by a minimum of the standard deviations; and

quantizing [[said]] eigenfeatures according to the corresponding bit allocation.

20 (currently amended). The [[A]] method [[in]] of claim 9, wherein [[of]] getting [[the]] weights of [[the]] adjusted first-order eigenfeatures for a distance computation ~~, comprising the steps of~~ comprises:

getting [[the]] standard deviations of [[said]] adjusted first-order eigenfeatures of [[the]] training face images; and

getting [[the]] weights by extracting [[the]] square roots of [[said]] standard deviations.

21 (currently amended). The [[A]] method [[in]] of claim 11, wherein [[of]] getting [[the]] weights of [[the]] adjusted second-order eigenfeatures for a distance computation ~~, comprising the steps of~~ comprises:

getting [[the]] variances of [[said]] adjusted second-order eigenfeatures of [[the]] training face images; and

getting [[the]] weights of the adjusted second-order eigenfeatures by extracting [[the]] square roots of said variances.

22 (currently amended). A method of measuring lighting-invariant similarity between faces, comprising ~~the steps of~~:

extracting [[the]] eigenfeatures of [[the]] faces for a lighting-invariant face description with the method ~~described~~ of claim 1;

getting [[the]] Euclidean distances of [[said]] eigenfeatures of the faces; and

choosing [[the]] a smallest Euclidean distance to indicate [[the]] a best matching pair of faces.

23 (currently amended). A method of measuring a view-angle-invariant similarity between faces, comprising ~~the steps of~~:

extracting [[the]] eigenfeatures of [[the]] faces for a view-angle-invariant face description with the method ~~described in~~ of claim 3;

getting [[the]] Euclidean distances of [[said]] eigenfeatures of the faces; and

choosing [[the]] a smallest Euclidean distance to indicate [[the]] a best matching pair of faces.

24 (currently amended). A method of getting code tables of variable length coding (VLC) for a light-invariant face descriptor, comprising ~~the steps of~~:

getting ~~the said~~ quantized eigenfeatures of [[the]] a training set with the method ~~described in~~ of claim 1;

classifying [[said]] eigenfeatures ~~in to~~ into groups depending on [[the]] bit allocations; and

constructing a code table for each ~~of the said~~ group of eigenfeatures with the same bit allocation, using an entropy coding method.

25 (currently amended). A method of getting code tables of variable length coding (VLC) for a view-angle-invariant face descriptor, comprising ~~the steps of~~:

getting ~~the said~~ quantized eigenfeatures of [[the]] a training set with the method ~~described in~~ of claim 3;

classifying [[said]] eigenfeatures ~~in to~~ into groups depending on [[the]] bit allocations; and

constructing a code table for each ~~of the said~~ group of eigenfeatures with the same bit allocation, using an entropy coding method.

26(currently amended). The [[A]] method of ~~constructing a code table in~~ claim 24, wherein ~~where~~ the entropy coding method [[is]] comprises a Huffman coding method based on [[the]] a probability of [[the]] a quantization level.

27 (currently amended). The [[A]] method of ~~constructing a code table in~~ claim 24, wherein ~~where~~ the entropy coding method [[is]] comprises an Arithmetic coding method based on [[the]] a probability of [[the]] a quantization level.

28 (currently amended). The [[A]] method [[in]] of claim 1, further comprising [[of]] coding a lighting-invariant face descriptor~~, comprising the step of~~ by:

looking up [[the]] a code table generated for each quantized eigenfeature and using [[the]] a corresponding code word to represent [[said]] the quantized eigenfeature.

29 (currently amended). The [[A]] method [[in]] of claim 3, further comprising [[of]] coding a viewing-angle-invariant face descriptor ~~, comprising the step of~~ by:

looking up [[the]] a code table generated for each quantized eigenfeature and using [[the]] a corresponding code word to represent [[said]] the quantized eigenfeature.

30 (currently amended). A method of extracting features for a general face description, comprising ~~the steps of~~:

getting adjusted first-order eigenfeatures of a face image with the method in [[the]] claim 7;

quantizing [[said]] adjusted first-order eigenfeatures; and

selecting features to construct face descriptor to describe faces from the [[said]] quantized first-order eigenfeatures.

31 (currently amended). A method of extracting features for general face description, comprising ~~the steps of~~:

getting adjusted first-order eigenfeatures of a face image with the method in [[the]] claim 7;

quantizing [[said]] adjusted first-order eigenfeatures; [[and]]

selecting features to construct face descriptor to describe faces from the [[said]] quantized first-order eigenfeatures; and

coding [[said]] selected eigenfeatures in the face descriptor.

32 (currently amended). The [[A]] method ~~in the~~ of claim 30, wherein [[of]] selecting features to construct a face descriptor to describe faces from the [[said]] quantized first-order eigenfeatures ~~, comprising the step of~~ comprises:

selecting [[The]] eigenfeatures corresponding to [[the]] a top N largest eigenvalues ~~are selected~~ for a view-angle invariant face description.

33 (currently amended). The [[A]] method ~~in the~~ of claim 30, wherein [[of]]

selecting features to construct a face descriptor to describe faces from the [[said]] quantized first-order eigenfeatures ~~, comprising the step of~~ comprises:

selecting [[The]] eigenfeatures corresponding to [[the]] a k-th to N-th largest eigenvalues (0<k<N) ~~are selected~~ for a lighting-invariant face description.

34 (new). A method of lighting-invariant a view-angle-invariant face description, comprising:

getting [[a]] first-order residual image data $\Gamma^{(1)}$, by taking face image data Φ as a vector and calculating its difference from a mean face image data Ψ;

multiplying the first-order residual image data $\Gamma^{(1)}$ and a combination of a first-order eigenmatrix obtained by decomposing the first-order residual image data $\Gamma^{(1)}$, and a second-order eigenmatrix obtained by decomposing second-order residual image data $\Gamma^{(2)}$ obtained by substracting first-order reconstructed image data from original face image data Φ, where the first-order reconstructed image data is obtained by adding mean face image data Ψ and a substantial low-frequency component extracted from the first-order residual image data $\Gamma^{(1)}$,

taking a result of the multiplicaiton as an eigenfeature of the face image data Φ;

quantizing the eignfeature;

encoding the quantized eigenfeature into variable length codes; and taking a result of encoding as the face descriptor.